V. *On the "Coffee-borer" of Southern India* (Xylotrechus quadripes, *Chevrolat*). By J. W. Dunning, M.A., F.L.S., &c., *Sec. Ent. Soc., late Fellow of Trinity College, Cambridge.*

At the meeting of the Society held on the 6th January, 1868, I exhibited specimens of the Coffee-tree attacked by the "borer," and of the larva, pupa, and imago of the insect, which were sent to me by the Rev. G. Richter, Principal of the Government Central School, Mercara, in the province of Coorg. The following extracts, relating to what my correspondent terms "the Borer pest in the coffee districts of Southern India," may prove interesting; and I have added a wood-cut of the beetle, with a few words on the genus *Xylotrechus* and its nearest allies.

From the Proceedings of the Agri-Horticultural Society of Madras, 1867.

(*Extract from the Season-Report of* Mr. J. W. Minchin, *dated* Wynaad, *May*, 1867.)

"In some of the dry districts many of the estates have suffered from the 'Borer.' The trees were probably attacked during the long drought of last season, and the consequences of its attack are now becoming apparent. It is evident that trees not in full vitality are most liable to the attack of the Borer, for on forest estates in moister localities there is very little seen. The remedy, therefore, is evidently to support the trees by manure, burying in weeds, and digging up the earth round the roots. This last I think should be done during the dry weather, not to any great depth, say three or four inches. It enables any dew or showers that may fall to penetrate the soil, and the feeding roots can search for fresh support, which, when the ground is baked hard, they are unable to do. I am sure that trees when assisted in this way will recover from the injury done by the Borer, and that it cannot be advisable to dig out the trees, although they should be relieved of dead wood and crop."

(*Extract from a letter of* Mr. Alexander Vertue, *dated* Ootacamund, 11 *June*, 1867.)

"In the neighbourhood of Goodaloor and Duralah, the Borer is making great havoc. As yet we have, however, every reason to hope that the crop from Terriout, South Wynaad, and the Charambady Division of South-East Wynaad will be very good.

With reference to the Borer, I myself believe that we are now paying the penalty for slovenly cultivation or total want of cultivation, which was generally the rule a few years ago in the coffee districts of this Presidency, and the droughts of three seasons have no doubt assisted the grub materially. On forest estates which from the commencement have been kept perfectly clean, or on bamboo estates which have been regularly trenched and kept in good order, I do not think the Borer will ever be very destructive. I may, of course, be in error as to this, but time will show. We hear of many remedies; one man recommends tar, another suggests that the trees should be washed with a solution of various things; but although these experiments may be tried with success in a garden, it is a very different matter when one has a field of 200 or 300 acres of coffee to work on."

(*Extract from a letter of the Rev.* G. Richter.)

"But what is the meaning of sickly-looking trees with drooping leaves that begin to turn yellow? We examine them closer. You shake such a tree—it cracks and breaks clean off just level with the ground! The broken stem betrays the cause of this destruction; we just see the retreating enemy: a footless yellowish-white larva with a ferocious horny mouth of darker hue. This is the Borer—the coffee-planter's terrible enemy! We split the stem of a six-years' old tree, and the open halves reveal in every direction a number of intricate passages infested by many larvæ. In some instances they are found in company with pupæ and perfect insects, ready to escape through the burrows opening outside the bark, and to deposit their eggs upon healthy trees.

The insect is not a 'fly,' as commonly called by planters, but a beetle belonging to the section *Tetramera* of the order *Coleoptera*, as it has four distinct joints to all the tarsi, and answers best to Cuvier's *Platysoma* and

the genus *Cucujus*. The species itself may perhaps be termed *Cucujus coffeophagus*. The full-grown beetle is about three-quarters of an inch long, and has an elongated cylindrical body. The head is small and depressed: the eyes are large and prominent, with a small whitish indentation near the root of the antennæ, which are filiform, eleven-jointed, and pointed at the tip, the first joint being thicker and the second shorter than the rest. The antennæ just reach over the prothorax. The mandibles are short, strong, and horny. The prothorax is slightly oval, nearly as broad as long, and marked by three black roundish spots, the middle one being four times larger than those on the sides. The remaining surface of the prothorax and part of the head are covered with short grayish hairs, that under the microscope present the appearance of a seal-skin in miniature. The upper wings are thin but horny, long, narrow and black, with three symmetrically curved greenish streaks or bands, and a perpendicular one at the top, forming on the left wing with the first curve the letter Y. The abdomen has six rings of a similar colour, and terminates in a horny sting-like appendix. The hind-legs are particularly long, and indicate, by their strong light-brown femora, considerable walking and jumping powers. The other joints are black, and the tarsi are armed with two cleft claws.

It does not seem that the beetle continues the devastation of the larva. I discovered in one tree larva, pupa, and beetle together; the larva boring upwards, the pupa lying inactive in a burrow opening outside and large enough for the passage of the perfect beetle, which I found with its head towards the opening of the hole. In some cases, as many as twenty-four larvæ have been extracted from a single tree, and one planter assured me that he saw the beetles swarming. Another observed some beetles seated on the stem of a tree, in the act, apparently, of depositing their eggs. It is under the bark, and, in most instances, directly above the root, that the larvæ begin their burrowing, winding half round the stem, and then working upwards and inwards in every direction; and when arrived at maturity, the larvæ seem to open a passage for the exodus of the future beetle, since the pupæ do not burrow.

Another more innocent Borer was known for some years—the red Borer. It was generally found in new wood, but though the top or a branch of a tree may have

withered, the tree itself was thereby not destroyed. The larva was red and larger than the one described, and no one troubled himself much about it.

The coffee-pest will—as the dark cloud of locusts—certainly pass over; the Borer does not of necessity belong to the coffee-tree; where there is hope there must be activity. Without doctoring and wasting money on doubtful remedies, I would destroy every affected tree on the plantation; for if once attacked, it is hopelessly gone. Though half an estate may be lost, where the means are available and the soil is good let it be planted over again, and, where the Borer has not yet shown itself, plant a new tree between every four, that it may replace any of the old ones should they be attacked, as the Borer prefers old stems. And since it seems to be an established fact that coffee-trees under judicious shading are free from Borer, let every planter in Coorg introduce shade-trees for his young coffee; at least give it a fair trial."

(*Remarks by the Committee of the Agri-Horticultural Society of Madras.*)

"For some years, an insect called the Borer has been known in Ceylon and other coffee-producing districts, but it is quite different from the one now in Coorg, being the caterpillar of a moth called *Zeuzera*, whereas the Coorg Borer, according to Mr. Richter, is the larva of a beetle. Another caterpillar, the Black Grub, has also done considerable mischief on coffee estates by ringing the stems just above ground; but it has never been so general, or appeared in such numbers, as the present enemy. It chiefly confines its attacks to young trees, and is the larva of *Agrotis segetum*. The curious in these matters will find abundant information on the subject in a pamphlet, 'Enemies of the Coffee Tree,' by J. Nietner, Esq., published in Ceylon in 1861. The Coorg Borer hardly appears to have been observed there until the present season, but now it has appeared so suddenly, simultaneously and in such numbers throughout a large province, and under such varying conditions as to soil, elevation, culture, &c., that there cannot be a doubt that it has been called into existence by the operation of some general cause. Both Mr. Minchin and Mr. Richter seem to think that this cause has been the long-continued

drought of the past two seasons, and we believe that is the generally prevalent and correct opinion. A dry state of the atmosphere is, under certain conditions, favorable to the multiplication of many forms of insect life, and, in the case of the *Scolytus* (a borer), which destroys the elm, it is a well-known fact that while a dry season fosters it, the presence of moisture and the rapid circulation of the sap immediately stop its ravages. Accepting the drought, therefore, as the chief agent in the production of the Borer, the most natural remedy, as suggested by Mr. Richter, appears to be cultivation of the coffee under shade; a system regarding which the Committee have for a considerable period been seeking to elicit the opinion of experienced planters. *Doctoring* by the application of remedies may be of temporary, but cannot prove of any permanent benefit, and will not avert the total ruin which at present threatens a most important branch of industry and source of revenue. It does not seem very clear whether the ova of the beetle that produces the Borer are hatched in the ground or not; but, if so, a liberal application of lime to the soil might, as in the case of the wire-worm, ensure the destruction of the insect."

(*Extracts from the* Coorg *Season-Report, by the Rev.* G. Richter, *dated* Mercara, 1 *July*, 1867.)

"Much has already been written about the 'Borer' in Coorg, but I should hardly do justice to my task did I not revert to the subject in my season-report on the the past quarter. I need, however, not enlarge on the blasted prospects of some planters who were so full of hope at the flowering season of the coffee-tree in March last. The epidemic is an undisputable fact, and elicits the sympathies of every one who has become acquainted with its ravages. These were especially apparent in April and May, but with the commencement of the rains they showed themselves less visible, whether to appearance only or really and permanently, the future will disclose. It is, however, confidently asserted by planters in various districts of Coorg, that the pest is passing away. Whilst sincerely wishing this to be the case, and feeling most inclined to forget the unpleasant subject altogether, still there are a few notable facts which may

prove interesting to the planter as well as to the entomologist.

In my description of the coffee-beetle, I should have added a few more characteristic traits of the destructive operations of the Borer, and a few touches on the organization and habits of the beetle.

On examining since a number of destroyed coffee-trees, green and dry and of various ages, in company with some planters, we elucidated these facts, and the accompanying sections of stems afford the proof.

Sections 6 and 7 are of a one-year old tree from an originally large plant, the diameter at the botom is one inch. The Borer penetrated just above the root, worked horizontally all round, leaving only a few fibres of wood near the centre and the bark all round, and then ascended sideways and upwards through the heart-wood for eight inches, when I discovered the Borer and stopped its progress. A slight shake was sufficient to break off the tree. On a young estate of one year's growth near Mercara, thousands of trees have thus been attacked and killed.

Sections 4 and 5 belong to a tree of four years' growth, and two and a half inches in diameter. The saw-cut is made just under the first pair of primary roots, and it shows a perpendicular burrow which reaches still further into the cut-off taproot. There are side passages opening outside the bark, and one cuts clear of the primary root. In this stem the Borer had not ascended beyond two inches above ground, the wood above is intact, but still the tree could not live. A pull and a wrench snapped it off above the root.

Section 8, of a tree two and a half inches in diameter, and four years old, shows the horizontal windings and the cross cutting power of the Borer. The cut is nine inches above the ground, but the lower part down to the root is eaten through. There is only three-eighths of an inch of wood left on one side holding the severed stem together, and a slight shake knocked the tree over.

Sections 1, 2, and 3 belong to five-year old trees, and clearly exhibit the fantastical intricate confusion of tunnelling by a multitude of Borers, which, however closely approaching, keep their burrows distinctly separate from each other. In all the above sections the interior passages, except the portion near the orifice, are closely packed with the woody excrements of the Borer. On the bark we observe numerous round open holes of

different dimensions, each communicating with a distinct burrow within. For the length of about two inches from the orifice these burrows are wider than further in, and more irregular in shape; in fact, they form the cradle of the struggling insect in its disentanglement from the pupa to the imago state, for it is here that the mature larva closes its destructive career, and rests awhile in the pupa state to resume its pernicious work on an extended scale by the beetle's numerous progeny.

The orifices are small and large, in proportion to the size of the Borer-larva and beetle, and it would appear that it is the larva which scoops out the passage for the beetle. It is, however, doubtful whether the hole through the soft bark is made by the larva or the beetle —a most important point to ascertain. The providential economy of insect life would lead one to suppose that the orifice is made by the beetle, which lies asleep in its cradle safe from intruding ants, till it opens the little bark shutter, and escapes from its dark chamber into the sunny air. In one instance I found a perfect beetle—dead; it could not escape, for the passage does not communicate with the outside, it stops short still in the hard wood. The beetle must have been alive, and if it were its habit to burrow, it would have eaten its way out of prison.

The female beetle is of equal size and appearance with the male, and is easily recognized by the horny sting-like appendage of the abdomen, which in the male terminates in a roundish sheath. On examining under the microscope the dissected abdomen of the female beetle, I found the ovary full of round yellowish-red eggs, and I am told on good authority that a planter who confined a pair of newly-hatched beetles under a glass counted two hundred eggs deposited by the female, which fecundity accounts for the numerous Borer brood in a single tree. The eggs are laid under the bark of a coffee-tree and close to the root, whether in a natural fissure of the bark or a puncture by the female beetle, is not certain; but the first burrowing of the newly-hatched larva can be traced to a slight hollow under the bark, whence it proceeds between the outer bark and liber till the larva is strong enough to eat into the hard wood. It does not seem that many eggs are deposited in one spot, for there are not many burrows radiating from one common point. The eggs are apparently laid in November and December, and hatched in the beginning of the

warm weather in February and March. The larva is full-grown by July, when it enters the pupa state, and is transformed into the beetle after the monsoon. I am, however, not so very positive about these data, but I hope to ascertain the facts after further investigation.

The symptoms of a tree with the Borer in it are these: cessation of vigorous growth, peculiar twisting or curling of the terminal leaflets of the primaries and secondaries, foliage in general languid and drooping, and, in advanced state of burrowing, yellow.

From all the foregoing statements we may draw the following conclusions:—

1. The white Borer penetrates the coffee-trees, and, especially when young, generally at or close to the root, originating from eggs which are deposited by the coffee-beetle (*Cucujus coffeophagus*), not cumulative but dispersed under the bark.

2. The larvæ ascend and descend the tree without interfering with each other's burrows, and prefer the hardest wood, themselves closing their passage behind as they proceed; they cannot be reached by any external means.

3. When mature, they approach the bark for their transformation, and it is probable that, though they burrow up to the bark, they do not penetrate it for the egress of the future beetle.

4. Any appliance of means to destroy the insects *in* the tree would only affect them *after* the tree has received irreparable injury. Remedies do not save the affected tree, but by killing the insects a further spread of the Borer pest is prevented.

5. It is therefore essential to know the time of the impending exit of the beetle, and should the orifices be open before the larva enters the pupa state, the closing up of these orifices by any insect-destroying drug would prove a safe remedy, not, however, for the preservation of the young and suffering tree.

6. The shortest way to effect the same result is the up-rooting and smashing of the tree at the first sign of the Borer.

A word regarding 'planting under shade.' Six miles from Mercara on the Virajpet road, in dense forest land, is the plantation of the Naib Sheristadar B. Bopie, adjoining to it that of a European planter. The latter estate has the Borer, whilst the former has it not. This is under shade, the other on an open clearance. The

shade is too dense, and consequently the trees look thin, lank, with dark green foliage and scanty fruit, but where they approach the clearing they are splendid in size and fertility, and have no Borer. This fact induces me to believe in judicious shading, whether in bamboo or forest land."

(*Extracts from the* Coorg *Season-Report, by the Rev.* G. Richter, *dated* Mercara, 15 *October*, 1867.)

"In my last season-report I stated some points as still doubtful, viz., the mode and time of egress of the coffee-beetle, the mode of depositing its eggs, the period of development of the several transformations of the insect. To investigate these matters, I made the following experiments.

1. On the 2nd August last I examined some coffee-stems with the Borer in them. I cut them up into several pieces of convenient size, and carefully split these open, to mark the position and appearance of the larvæ; three of these seemed to be full grown, and four of smaller size. Joining the pieces carefully together, I preserved them in a glass box. On re-opening them after a few days, the larvæ had filled the exposed burrows with the woody excrements and made themselves invisible. Yesterday (14th October) I split the same pieces in different places, and out of the seven Borers in the larva state on the 2nd August I found three transformed into the pupa state, the other four were still larvæ in full activity. The pupæ lay with their heads close to the bark, which was however *not* perforated.

2. On the 3rd Oct. I split a dozen trees attacked by Borer, and secured four pairs of full-grown beetles alive, besides many pupæ and larvæ. In every instance I found the two former in their burrows, shut up from the outside by the bark only.

In order further to examine the habits of the beetle, and especially the mode of laying its eggs, I made arrangements which represented as much as possible the natural condition of the habitat of the insect. I took a glass shade two feet high, nine inches wide, and open at both ends. This I placed upon a board, and cutting the stem of a fresh coffee-tree into two pieces of the requisite height and lateral width, with leaves attached, I placed them in the cylinder, the bottom of which I covered with

two inches of earth, taken from round a coffee-tree. It was towards evening when I liberated the beetles from their dark narrow prison, and placed them in the glass; they were very lively, and I expected a strong light would have now, if at all, a most startling effect upon the insects; but they remained perfectly indifferent, and likewise during the following nights, when at different hours I approached the glass with a bright lamp-light. The insects are therefore not nocturnal or crepuscular like moths and flying ants, and lighting fires or hanging up lanterns, to attract and catch them, is quite useless. The coffee-beetle, as I shall presently show, is most active during the hot hours of the day, quiescent during the night, and rather so during the cool hours of morning and evening.

On Friday morning, the 4th October, I watched the four pairs of beetles most attentively. To distinguish them individually, I mutilated their legs in different ways. The glass was kept in an open verandah, and about nine o'clock, when the sunlight fell upon it, the beetles set out to reconnoitre their terrain. They walked about quite sprightly, ascended the stems, even marched up and down the glass, and clambered over the uneven soil, which, however, on account of their long and clawed hind-legs, they found rather difficult to accomplish, and, if upset, they could not easily turn over. The stem of the coffee-tree they evidently enjoyed as their home. If it were not for the calamitous ravages of the insects, one would feel inclined to observe them with admiration. They are pretty in appearance, elegant in form, attentive to their toilette, smart in their movements, and easily offended by an opponent, whom they attack unmercifully with their horny mandibles. When together in close quarters, they bite off each other's limbs in the struggle for ascendancy. In a glass bottle, where I kept ten beetles for three hours, I found the bottom covered like a battle-field with mutilated limbs. They do not readily take to their wings, but, though not constituted for long flights, they can easily fly from one tree to another.

After eleven o'clock, I observed their inclination to that function of insect life, which seems to be the very purpose of their existence in the perfect state. There were at first only two pairs in activity, and the females soon afterwards commenced depositing their eggs, generally moving along with the males superimposed; they are, however, not monogamous. The eggs are not

laid in any regular order, but the female beetle roams over the stem in every direction, except under ground, and places her eggs alongside and into the natural fissures of the bark. The ovipositor is so organized that it serves as a most flexible and delicate feeler of the proper locality for the egg, as well as for conveying the egg to that spot. As the beetle moves over the stem, this organ is in constant activity, sweeping like the finest hair-brush over and into every little cavity, and stopping occasionally with unerring instinct in the proper place, where it securely drops one or several eggs. After ten days' careful observation, I am unable to say with any degree of certainty, how many eggs each female has laid or may lay. Of the eight beetles put into the glass, five died after six days' activity; they laid daily some eggs; two females and one male are still alive and active. Yesterday and to-day I examined the two stems, to discover the eggs, and I found on one piece, one foot nine inches in length, over fifty eggs, and on the other, one foot long, thirty-four eggs. The greatest number, grouped in one fissure, was eight eggs; there are none upon the branches on account of their smoothness, but they are most numerous in and round the axilla of the primaries. The eggs are whitish, elongated, and pointed at the top. The laid eggs are so securely hidden in the fissures of the bark, whether perpendicular, oblique or horizontal, that they are visible only on removing the epidermis and part of the corky layers of the bark. One burst open, and I secured the embryo larva, which is just discernible with the naked eye, but which under the microscope exhibits every characteristic of the full-grown Borer, even the reddish-brown head.

3. In order to find out what effect coating the stem with lime would have upon the beetles, I treated a piece of a fresh coffee-tree in this manner, fixed it into another glass shade, and put the ten mutilated beetles into the glass. Those which still were able to walk, attempted to crawl up the tree, but soon fell off, their claws could only seize the coating of lime, which peeled off and caused the beetle to fall. Next morning most of them were dead. Yesterday I transferred the three active insects of the former experiment to the white-washed stem, and added a second male. They managed to climb up the stem, but the females found on the white-washed surface no hiding-place for their eggs, and repeatedly dropped to the ground. I left purposely the axilla of a primary

unwhitewashed ; this they soon found out, and deposited there the eggs. This evening a shower of rain fell, when I exposed the open glass to its full influence. The beetles sought shelter under the primaries, and are, I believe, not much affected by the rain.

As a *resumé* of all these experiments and observations, I venture to draw the following conclusions, in addition to, and modification of, my former statements :—

1. It is the beetle and not the larva, which, for its egress from the tree, eats a hole through the bark. Any artificial injection or filling up of these holes to destroy the pupæ or larvæ, would be like locking the door after the horse is stolen.

2. Since the larvæ in the tree cannot be reached by any external remedy, we are left to deal with the beetle and its eggs only.

3. The beetle is diurnal in its activity, not gregarious or migratory, and unaffected by light at night. It is generally quiescent during the cool hours of the day, and seated upon the stem. It may therefore with ease be collected. No doubt many are carried off by birds ; these should therefore be encouraged on an estate by fruit-yielding shade trees. It appears that lizards also are active in destroying the beetles.

4. The beetles make their appearance directly after the monsoon, propagate their species, and die off, but are replaced by new generations all during the dry weather. I have not observed that they feed on any part of the coffee-tree.

5. The eggs are hatched within a fortnight after deposition, and it is in the state of the larva that the insect has its longest existence, which may be estimated at about nine months. The pupa lives as such in a quiescent state in the tree for about two months, and the beetle, after its egress, exists but for the short space of a fortnight.

6. There is no human remedy which would, as by magic, dispose of the Borer-brood wholesale ; we must grapple with the plague in patient, painstaking, and successive efforts, which will be the easier, the younger an estate is, and the less damage has been done.

7. Every attention must now be directed towards the prevention of a successful deposition of the beetle's eggs, or the hatching of the same.

8. The cheapest and most efficient way to obtain both objects, appears to me this—first, rubbing energe-

tically the bark of the stem, and especially round the axilla of the primaries, with a rough coir-glove, as used for cleaning bullocks, or still better, with a short wire brush, made in the shape of a nail-brush; mere hand-rubbing is impracticable to a large extent; and secondly, white-washing the stems from top to bottom, and the primaries from the axilla one or two inches upwards with lime. The lime will, eventually, when dropping off, serve as manure and repay its cost. Tar is too expensive and apt to kill young trees. To make the lime more adhesive, a gelatinous liquid, obtained by soaking the bark of the wild cinnamon and Culur Mavina or Poon tree in water, may be admixed.

9. These remedies are, however, only preventive against the spread of the Borer-pest, and do not save a tree already far gone. Any such tree must be eradicated and destroyed.

10. As the Borer appears, however, generally sporadic on an estate, it would appear sufficient, to treat at first—but without delay—the healthy trees which are in the neighbourhood of such affected spots, after having carefully destroyed the Borer trees.

11. He to whom such treatment appears impracticable to a large extent, must make up his mind, either to save with certainty a smaller area, or risk the inevitable destruction of his whole estate.

12. From the difficulty we find in overcoming this plague on an extensive acreage of cultivation, we may learn, perhaps, the true mode of coffee culture, and the truth of the maxim: that a hundred acres, well cultivated and carefully superintended, are more profitable than a thousand that cannot be properly managed."

(*Extracts from a Report by Dr.* George Bidie *to the Madras Government, dated* 16 *Oct.* 1867.)

"I have the honour to report, for the information of Government, that, in the month of September, I visited Coorg, with a view to collect some facts regarding the ravages of the insect called the Borer, which has lately caused such destruction on coffee plantations there, and in the neighbouring districts of Wynaad and Munzerabad. It is now upwards of four years since I last visited Coorg, and the first thing that struck me on the present occasion was the altered appearance of the country. In every

direction the sides of the hills and ravines have been stripped of their umbrageous forests, and, instead of the magnificent expanse of living green that used to meet the eye on all sides, we have numerous sterile-looking tracts, which give a peculiar air of desolation to the prospect. Did the evil, however, effected by clearing, not extend further than this, it would be of no great consequence ; but, as has already been brought to the notice of Government, the extensive destruction of forests in Coorg has had a serious effect on the streams, that, rising amongst its hills, descend to fertilize the plains. There is no reason to suppose that, although every tree in Coorg were cut down, the rain-fall would be sensibly diminished, as its amount depends chiefly on the geographical position and physical conformation of the country, but the existing clearing has, undoubtedly, had the effect of causing a large portion of the monsoon water to run off almost immediately, instead of lodging in the forests as it used to do, and, by evaporation, rendering the air moist during the dry season. I have no doubt that this change in the drainage of the country caused the droughts of late years to affect Coorg much more seriously than they would otherwise have done, and feel sure it will continue to render the culture of coffee there always more or less precarious. Coffee is a plant which delights in a moderately warm and moist atmosphere, and suffers much when subjected to a dry heat. Considering, therefore, that in Coorg it is deluged with rain during six months of the year, and exposed to scorching sunshine, with the earth baked as hard as a brick, during the remaining period, it is astonishing that it thrives there so well as it does. I have made the foregoing remarks with a view to show, that the vigour of the coffee plant may have been impaired by the accidental changes that have recently taken place in the climate through the great destruction of forests.

Much of the land now under coffee in Coorg is very ill-suited for the purpose, it being so steep that no care or ingenuity can prevent the surface soil from being washed away. Two or three monsoons are, in general, sufficient to sweep off every trace of *humus*, and the plants then get down on the cold hungry subsoil, which consists chiefly of clay, decaying gneiss and kaolin, and is notoriously deficient in lime, phosphates, and other elements, without which coffee cannot live and produce remunerative crops. Owing to this and the exhausting effects of

fruiting, plants on estates which have been five or more years in existence, have, as a rule, a very sickly look, and, under the present system of culture, must have speedily disappointed the hopes of their proprietors, although the Borer had never made its appearance. On most estates, too, the system of pruning is improper, and has been the chief cause in inducing a disease called *rot*. This distemper makes its appearance during the rains, when the plants are saturated with moisture, and attacks the leaves, many of which turn black and fall off. Whenever the leaves drop, the berries near their insertion also fall down, and, in this way, as much as one or one and a half bushel per acre of crop may be lost. The immediate cause of the disease seems to be the overcrowding of the branches, which prevents the necessary exposure of the leaves, &c., to light and air, and so retards perspiration, assimilation, and the due ripening of wood in the stem and primaries. In some plants affected with rot, I have found the centres of the stems in a state of decay, brought on, no doubt, by the complete stagnation of the circulation. The quantity of weeds allowed to grow on some estates is also most prejudicial to the coffee, and the practice of piling them round the base of the stem when uprooted, highly objectionable. Every English gardener knows how much the gooseberry bushes in a neglected garden suffer from caterpillar, and there is every reason to suppose that a foul coffee estate is equally inviting to the Borer. These several causes, then, have greatly lowered the vital powers of the coffee-plant in Coorg, and helped to render it a ready and easy prey to the Borer.

Other depressing agencies arose in the droughts of past years, which not only acted most detrimentally on the coffee, but also appear to have produced a peculiar state of the atmosphere, highly favourable for the development of its insect enemies. Throughout the whole of Western Mysore and Coorg, the abundance of wood-destroying insects has, during the past year, been such as to attract general notice, and plants of all kinds, from the jack to the bamboo, seem to have suffered from their ravages. The common opinion is that their appearance in such numbers is an effect of the drought, and this would seem to be the correct one, as there was no other general appreciable cause in operation, and because the explanation is consistent with established facts regarding the influence of atmospheric conditions on insect

life. Throughout the whole of 1866, then, the coffee in Coorg was generally in a sickly condition, partly from the effect of causes already referred to, and partly from those of the droughts. At the beginning of the present year, too, the amount ef blossom put forth by the coffee was such as had never before been seen by the oldest planter, and, although looked upon by many as a propitious sign, it was doubtless but a symptom of the feeble condition of the plant; as it is a well-known fact that plants in a sickly condition often produce an unusual number of flowers. No doubt, this effort on the part of the coffee still further reduced its powers, as no phenomenon of plant life is more exhaustive in its effects. Altogether, therefore, the coffee-plant in Coorg has for some time been in such a weakly state as would render it peculiarly liable to disease, and during the past twelve months, the White Borer has found in it a highly congenial field, in which to live and multiply. I shall say nothing of the Red Borer, as, confining itself chiefly to tender branches, it is not nearly so destructive in its operations as the other one, and, besides, it has never appeared in great numbers. For the last few years, occasional specimens of the White Borer have been observed by planters, but it is only of late that they have appeared in such numbers as to cause alarm. At the present moment, I do not believe that there is an estate in Coorg free from the pest, while one at least has been rendered worthless, and many more will be in nearly the same condition before the advent of the rains in 1868. In fact, this branch of industry is threatenod with complete extinction, and it is very humiliating to think that the cause is a tiny insect, of which a man could crush a thousand between his palms. To enter into the natural history of the insect, were the facts at my disposal sufficient to enable me to do so satisfactorily, which they are not, would, in my opinion, be of little avail, as remedial measures, to be successful, must be directed against the causes that have favoured the production and increase of the insect, rather than against the creature itself. Indeed, at first, the operations of the enemy are so insidious, that it is generally impossible to say whether a tree has been attacked or not, and it is only when the work of destruction has gone beyond all remedy that symptoms of what has happened become manifest. The signs of Borers being in a tree are drooping of the younger leaves, and, ultimately, a yellow colour in the

whole of the foliage. In advanced stages, the leaves drop off, and, after a few abortive attempts to put forth fresh buds, the plant withers and dies. After the leaves have become yellow, a very slight force will break the stem across, when the tunnels of the enemy, accurately filled with the *débris* of the wood in a fine state of division, will be observed. These are generally about the diameter of a small quill, and are always confined to the wood, never entering the bark until the larva has done its work, passed through the pupa stage, and is about to escape in the form of a beetle. It is the larva of the insect that is called the Borer, and which proves so destructive in its habits. The eggs from which it is developed would appear to be deposited immediately under the bark of a plant near the ground, by means of a telescopic-looking strong ovipositor, with which the abdomen of the female beetle is furnished. It has not been ascertained whether, in performing this operation, she takes advantage of one of the numerous cracks in the outer bark, but it is probable that such is the case; as, by so doing, she would, without difficulty, reach the tender inner layers which the ovipositor would easily penetrate, and thus place the germs of her future progeny in contact with the mucilaginous *cambium* which would supply them with nutriment, until they acquired sufficient strength to commence tunnelling operations in the wood. The tunnel made by the young Borer is but small (about the diameter of a netting needle), and entirely confined to the sapwood. It does not continue long of that size, however, but gradually gets larger as the insect increases in bulk and strength, and then the hard central wood of the stem is attacked. As the Borer works into the stem, it seals up the passage behind it with the *débris* of the wood, so firmly agglutinated by some mucilaginous fluid that it can be removed like a cast of plaster of Paris on laying open the tunnel. This occlusion seems to be necessary for the existence of the larvæ, for, on laying some of them bare, with the view of watching operations, exposure to light and dry air speedily proved fatal. A considerable number of Borers are generally found in one stem, but, although their passages are very intricate and eccentric in their course, the tunnel of one very rarely communicates with that of another. Roots are just as frequently destroyed by them as stems, the larvæ travelling downwards; and when the wood of the stem has become nearly exhausted, they

frequently strike off into branches. The full grown Borer or larva is generally from three-quarters to one inch in length, and about the diameter of a quill at the head. The body is whitish, soft, ringed, destitute of feet, thickest in front, and tapers gradually toward the blunt posterior extremity. The head is harder than the body, and furnished with very powerful mandibles. When the larva has completed its term of existence, during the whole of which its entire energy is expended on feeding, it approaches the surface of the stem, and, passing into a state of inactivity, becomes a pupa. How long it remains in this state is doubtful, and all that we know with certainty is that the imago is produced in a cavern prepared for it by the larva in the sapwood, or immediately under the bark, and that, having got through the process of exuviation, it cuts its way out in the shape of a perfect beetle. Instead of living in a dark hermetically-closed tunnel, it now exists in light and air, soaring on wing, or jumping with its powerful legs. It is at this time about half an inch in length, or sometimes a little more. The head is small, depressed, and furnished with robust mandibles, tapering antennæ, and large brilliant reniform eyes. The elytra are black, and each is marked with three oblique greenish bands, meeting in pairs at their inner extremities when the wing-cases are folded, and by a diagonal one at the upper end. The hind-legs are long and powerful, and the basal joints of their tarsi are furnished beneath with brush-like appendages. The insect belongs to the tetramerous family of Coleoptera or beetles, and will doubtless be soon in the hands of English Entomologists, able to identify it, and give a full account of its natural history. We have as yet no reliable information regarding the periods of the year at which the insect is to be found in its various stages of development. In the trees examined by me in September, I found only larvæ. Probably the beetle or perfect insect emerges in the dry season, or earlier months of the year, as it would hardly be possible for it to live during the heavy rains of the monsoon. The Borer does not attack dead stems.

It will be observed that, through the whole of this letter, I have endeavoured to show that the coffee-plant in Coorg has been subjected to various debilitating influences, which have predisposed it to disease, and I now wish to say that I look upon the Borer as akin to an epidemic. Change in the climate, impoverished soil, and

bad cultivation reduced the vital powers of the plant to a minimum, and the severe drought of past years then furnished the special influence that caused the pest to increase to such an extent. There is no other rational method of accounting for a scourge that has appeared simultaneously in so many districts so far removed from each other, and under such varying circumstances. At the same time, there is no doubt that, when once the disease has appeared on an estate, it will not confine itself to sickly plants, but, when these have been used up, extend its ravages to the most vigorous and healthy. That a general debility in the coffee-plant has been a powerful predisposing cause is, I think, sufficiently evident from the following considerations :—

(*a.*) Plants purposely or accidentally manured (such as those around coolie lines), and thus in vigorous health, rarely suffer much from Borer, while others in the immediate neighbourhood, in which this condition is absent, suffer severely.

(*b.*) Plants on newly opened estates, in which the soil has not been exhausted, escape entirely, or suffer but slightly.

(*c.*) Plants on dry, barren, and exposed ridges suffer soonest and most severely. Shade does not appear to protect plants from Borer in Coorg, and, although it did, the climate of a great portion of the district is such as to render its use impracticable, the shutting out of light and air by it during the rains, when the plants and atmosphere are saturated with moisture, and the heavy drip rendering the coffee sickly and unproductive. In bamboo lands, and places where the monsoon is less heavy, however, it may prove useful. I may mention one curious and suggestive fact regarding shade that was brought to my notice by a planter. When shade was talked of some time ago, he tried an experiment on a small portion of the estate with the charcoal-tree (*Sponia Wightii*) to afford shade, and the result was that the charcoal-tree was riddled with Borer, while the coffee escaped entirely. This result would seem to support a proposition, enunciated by the late Inspector General Macpherson, who had given great attention to coffee culture, viz., ‘ that the Borer had attacked the coffee because the trees in which it used to live in the jungle had been cut down.’ It is quite possible there may be some truth in this, but, at all events, the rearing of belts of the charcoal-tree on estates, so as to afford shelter

from dry and scorching winds, and give the Borer a less expensive food than the coffee-tree, seems deserving of a trial. Farmers and gardeners at home are quite familiar with expedients of this kind for getting rid of the larvæ of insects destructive of fruit-trees or crops. I examined the Borer found in the charcoal-tree, and it seemed identical with the coffee one. As I have hinted already, it seems perfectly futile to attempt to stop the increase of, or to extirpate, the Borer by doctoring individual trees, and the truth of this will become apparent when we consider for a moment that every acre on an estate contains an average from 1800 to 2000 plants, and that the larvæ live in the interior of the stem. On the other hand, there cannot be a doubt that the complete destruction by fire of every coffee-shrub infested with Borer is a most essential preventive measure, as every Borer permitted to live may produce a beetle, and every female beetle may deposit at least 200 eggs. For *stamping-out* measures of this nature, some combination amongst planters is highly desirable, as a *bored* estate, in which such means are neglected, will prove a source of danger to others in its neighbourhood. I think, however, that the efforts of the planter should chiefly be directed towards the introduction of a superior mode of cultivation, so as to get the plants into better condition."

Dr. Bidie has since been appointed by the Madras Government a Special Commissioner for investigating the ravages of the Borer in Mysore and Madras. I am indebted to Mr. Daniel Hanbury for the following extracts.

(*Extracts from a letter of Dr.* George Bidie, *dated* Veerajpettah, (*Coorg*), 21 *Dec.* 1867.)

"In the little kingdom of Coorg two or three coffee estates have been almost entirely cleared of their trees by the Borer; some have lost from 8 to 50 per cent., and none on which the plants are upwards of three years old, have escaped entirely. Plants less than three years old are rarely attacked, and the older the tree the more liable is it to suffer. The eggs of the insect are deposited in cracks of the bark on the stem, from 3 to 18 inches above the surface of the ground. When hatched, the little larva works in the *cambium* until it has strength

to enter the wood, and by so doing occasions a small ridge on the bark, which is a sure sign of Borer being in the tree. Once in the wood, it tunnels in all directions, now going up, now down, or proceeding in corkscrew fashion. As it works its way, it seals up the passage behind it with the *débris* of the wood in a fine state of division, but so firmly agglutinated by some mucilaginous fluid, that it can be removed out of the tunnel like a cast of plaster of Paris. As a rule there is more than one larva in a tree, and I have found as many as twelve in a single stem. Very often the Borer also tunnels the roots of the tree, but it almost uniformly returns again to the stem, having completed its work of destruction below ground. After living for some months in the larva state, the Borer approaches the surface of the stem, where, having prepared a small chamber, it passes into the pupa state; this chamber is usually situated in the sapwood, but I have often seen it in the very centre of the stems. In a few weeks the perfect beetle eats its way out, and the hole thus made is the first one visible on the exterior of the tree. The beetle thereafter lives entirely in the open air, resting by night, and becoming active in the sunshine. The larva, pupa, and beetle are to be found in every month of the year, and all three forms may frequently be seen simultaneously in a single tree. This, and the circumstance of the larva and pupa living in the interior of the tree, render it very difficult to devise any means for the destruction of the pest. I have been recommending the uprooting and destruction by fire of trees as soon as they exhibit any signs of the insect being in the interior, and the coating of the lower part of the stems of young trees with coal-tar, so as to prevent the deposition of eggs . . . . . My time is now chiefly occupied in estimating the damage done by the Borer, and during the last month I have on an average been from 8 to 10 hours daily in the saddle, and have thus little time left to extend and arrange my rough notes."

Mr. Richter is in error in supposing the Borer-beetle to be a *Cucujus;* it is an unmistakeable *Clytus,* or rather it belongs to that group of the old genus which M. Chevrolat has recently separated under the name of *Xylotrechus,* and is the *Xylotrechus quadripes* of that author, described in the "Clytides d'Asie et d'Océanie" (Mém.

Soc. Roy. des Sci. de Liége, xvii. p. 63). A single specimen is in M. Chevrolat's collection, now in the British Museum; and so far as I can learn, this species was known in Europe only by that solitary individual, until attention was pointedly called to it by the serious injury done to the coffee plantations of Southern India in 1867.

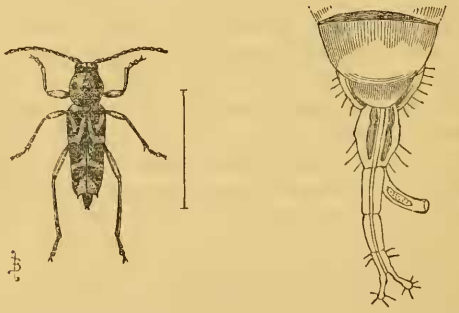
Fam. CERAMBYCIDÆ, Div. CLYTINÆ.

Gen. XYLOTRECHUS, Chevr. Ann. Soc. Ent. Fr. 1860, p. 456.
„ Mém. Soc. Sci. Liége, 1863, p. 59.

XYLOTRECHUS QUADRIPES.

Xylotrechus quadripes, Chevr. Mém. Soc. Sci. Liége, xvii. 63 (1863).

Cucujus coffeophagus, Richter, Proc. Agri-Hort. Soc. Madras, 1867.



The facial carinæ of this insect seem to point to *Xylotrechus*, but the globose prothorax is more characteristic of *Anthoboscus*, *Chlorophorus*, or *Sphegesthes*. In the absence of the type-specimen, for comparison with those sent by Mr. Richter and Dr. Bidie, and judging from description only, I should have referred the beetle to *Anthoboscus* (*Clytanthus*, Thoms.). The specific description given by M. Chevrolat is sufficiently accurate, and indicates the *Clytus vicinus* of Laporte and Gory as a near ally of *quadripes*. The specimens received from Coorg are pretty constant in colour and marking, but vary in size, the males ranging from 5-7 lines, and the females from 6-8 lines in length.

The figure of the ovipositor, as seen under continued pressure of the abdomen, has been reduced from a magnified drawing which was kindly sent me by the Rev. G.

Richter. The projection on the right hand side would seem to be a portion either of the alimentary canal, or of the ovary-duct, which has been forced through a fracture of the ovipositor.

I may perhaps be allowed to say a few words with respect to the recent sub-division of the old genus *Clytus*, and will confine myself to the period since 1860, and to the group of *Clytinæ* most nearly allied to the now notorious coffee-borer.

In the "Description d'Espèces de *Clytus* propres au Mexique" (Ann. Soc. Ent. Fr. 1860, p. 455) M. Chevrolat divided *Clytus* into eleven groups or divisions, the fourth, fifth, and seventh, of which he called respectively *Anthoboscus*, *Clytus* (true), and *Xylotrechus*. The type species of *Anthoboscus* was the Mexican *tricolor*, Chevr., and to this division were also referred the European *Massiliensis* of Linnæus, and *plebeius*, *trifasciatus*, and *ornatus* of Fabricius. In *Clytus* (true) were retained *arietis*, Lin., *rhamni*, Germ., and *lama*, Muls., &c. The type of *Xylotrechus* was again a Mexican species, *Sartorii*, Chevr., but the European *Hafniensis*, Fab. (=*liciatus*, Lin.), *arvicola*, Oliv., and *antilope*, Ill., and numerous Asiatic species, were indicated as belonging to this division.

In the same year (1860) Mr. James Thomson published his "Essai d'une Classification de la Famille des Cérambycides," in which most of the "divisions" of M. Chevrolat are raised to generic rank, and other new genera are propounded. *Clytus* (p. 217) is restricted to the group of which the *robiniæ* of Forster is taken as the type. *Anthoboscus* (p. 219) is restricted to the Mexican species indicated by M. Chevrolat, and is said to be scarcely distinct from *Plagionotus*. *Xylotrechus* is extended to comprise three divisions; the first containing *Sartorii* and its allies; the second (named *Europa*, and afterwards *Clytumnus*) containing *Massiliensis*, *plebeius*, *trifasciatus*, *ornatus*, *arietis*, *rhamni*, *arvicola*, *antilope*, and also the *floralis* and *annularis* of Fabricius; the third containing the *semipunctatus* of Fabricius and the *perspicillus* of Fischer (= *comptus*, Mannerheim).

In 1862-63, M. Mulsant published a new edition of his "Longicornes de France," in which he divided "Les Clytaires" into three genera, *Plagionotus*, *Clytus*, and *Anaglyptus*, and again divided *Clytus* (p. 143) into five sub-genera, *Echinocerus*, *Xylotrechus*, *Clytus*, *Anthoboscus*, and *Isotomus*. *Echinocerus* is represented by *floralis*; *Xylotrechus* includes *liciatus*, *arvicola*, and *antilope*;

Clytus includes *lama, arietis,* and *rhamni; Anthoboscus* includes *trifasciatus, plebeius,* and *Massiliensis;* whilst *Isotomus* is composed of *semipunctatus* and *comptus.*

In 1863 M. Chevrolat's "Clytides d'Asie et d'Océanie" appeared. Amongst other new genera, *Chlorophorus* (p. 38) is proposed for *annularis* and its allies. *Anthoboscus* (now a genus) includes *ornatus, Macaonensis,* plebeius, perspicillus,* and numerous other species. *Clytus* includes *floralis. Xylotrechus* (now also a genus) is divided into nine divisions, the third of which is sub-divided into three groups; amongst the 27 Asiatic or Oceanic species enumerated are *quadripes, vicinus,* Lap. & Gory, and *ibex,* Humm. (said to be allied to *arvicola*). At p. 81, the genus *Sphegesthes* is founded, and *arietis, rhamni, lama* and *arvicola* are referred to it, together with the *capra* of Germar.

Lastly, the "Systema Cerambycidarum" of Mr. James Thomson was published in 1864. In this work the author abandons the limits of *Clytus* and *Xylotrechus* as defined in the "Essai" of 1860. The original limits of *Clytus* as defined by Von Laicharting in 1784 are now adopted, (p. 186), *arietis* is re-instated as the type-species, and *Europa* (=2nd div. of *Xylotrechus,* Thoms. 1860), *Sphegesthes,* and *Echinocerus,* are sunk as synonyms. *Anthoboscus, Chlorophorus,* and *Isotomus* (=3rd div. of *Xylotrechus,* Thoms. 1860), are merged to form the genus *Clytanthus* (p. 190), the names *Anthoboscus* and *Chlorophorus* being rejected on account of their having been already employed for genera of insects, whilst *Isotomus* is discarded as being a "nom trop voisin de celui d'*Isosomus*;" † the type-species of *Clytanthus* being *tricolor,* the original

* This species was first described by M. Chevrolat, at p. 98 of the Rév. Zool. 1845, in a paper entitled "Description de dix Coléoptères de Chine des environs de *Macao.*" By a typographical error the name is there printed *Macaumensis;* and by a second error, the insect appears in the "Clytides d'Asie" (p. 45) as *Anthoboscus Macausnensis.*

† See a note by Mr. Pascoe "On generic Names having nearly the same Sound," in Proc. Ent. Soc. 1865, p. 85, in which it is stated that Mr. James Thomson had previously changed the name *Orthostoma* because of its supposed resemblance to *Orthosoma.* I can only suppose that Mr. Thomson is in the habit of speaking of *Orthŏstŏma* and *Isosŏmus!* But if the derivation of the names be attended to, there is no very great fear of confusion between *Orthostŏma* and *Orthosōma,* or between *Isotŏmus* and *Isosōmus.* A better reason for the rejection of *Isotomus* would have been the fact that the same name has been applied to a genus of plants; but according to modern notions this is an insufficient ground, and botanists have now ceased to discard names pre-occupied by zoologists. Zoologists however will do well to avoid the intentional use of generic names already employed by botanists. *Factum valet, fieri non debet.*

type of *Anthoboscus*. Lastly, *Xylotrechus* (p. 190) is again reduced to its original dimensions, with *X. Sartorii* for its type, as defined by Chevrolat in 1860.

It is not very clear, even now, where Mr. Thomson draws the line between *Clytus* and *Clytanthus*. *Europa*, Thoms., is given as a synonym of *Clytus*, and *Anthoboscus*, Chevr., as a synonym of *Clytanthus*. But this cannot be more than approximately true; *Europa* included *annularis*, the type of *Chlorophorus*, which is merged in *Clytanthus*; and there are various species—*e. g.*, *ornatus* and *plebeius*—placed by Thomson in *Europa*, which by Chevrolat were placed in *Anthoboscus*. I understand *Clytus* (Thoms. 1864) to include the whole of *Europa* (Thoms. 1860), with the exception of *Chlorophorus* (Chev. 1863). If this be not Mr. Thomson's meaning, he has omitted to show which of the species of his *Europa* belong to *Clytus* and which to *Clytanthus*.

At the risk of a little repetition, I will exhibit in a tabular form the changes in generic nomenclature made by the above-mentioned authors within a period of five years, as they affect the half-dozen species which have so long been known by the names given in the left-hand column :—

Clytus arietis, Lin.	= *Clytus* (div. *Clytus*) *arietis*, Chevr. 1860.
	= *Xylotrechus* (div. *Europa*) *arietis*, Thoms. 1860.
	= *Clytus* (subg. *Clytus*) *arietis*, Muls. 1862.
	= *Sphegesthes arietis*, Chevr. 1863.
	= *Clytus arietis*, Thoms. 1864.
Clytus arvicola, Oliv.	= *Clytus* (div. *Xylotrechus*) *arvicola*, Chevr. 1860.
	= *Xylotrechus* (div. *Europa*) *arvicola*, Thoms. 1860.
	= *Clytus* (subg. *Xylotrechus*) *arvicola*, Muls. 1862.
	= *Sphegesthes arvicola*, Chevr. 1863.
	= *Clytus arvicola*, Thoms. 1864.
Clytus plebeius, Fab.	= *Clytus* (div. *Anthoboscus*) *plebeius*, Chevr. 1860.
	= *Xylotrechus* (div. *Europa*) *plebeius*, Thoms. 1860.
	= *Clytus* (subg. *Anthoboscus*) *plebeius*, Muls. 1862.

Clytus plebeius, Fab. = *Anthoboscus plebeius*, Chevr. 1863.
= *Clytus plebeius*, Thoms. 1864.

Clytus floralis, Pallas = *Xylotrechus* (div. *Europa*) *floralis*, Thoms. 1860.
= *Clytus* (subg. *Echinocerus*) *floralis*, Muls. 1862.
= *Clytus floralis*, Chevr. 1863, and Thoms. 1864.

Clytus ruficornis, Oliv. = *Xylotrechus* (div. *Europa*) *ruficornis*, Thoms. 1860.
= *Clytus* (subg. *Anthoboscus*) *ruficornis*, Muls. 1862.
= *Clytus ruficornis*, Thoms. 1864.

Clytus annularis, Fab. = *Xylotrechus* (div. *Europa*) *annularis*, Thoms. 1860.
= *Chlorophorus annularis*, Chev. 1863.
= *Clytanthus annularis*, Thoms. 1864.

Clytus comptus, Mann. (= *perspicillus*, Fisch.) = *Xylotrechus* (div. 3) *perspicillus*, Thoms. 1860.
= *Clytus* (subg. *Isotomus*) *comptus*, Muls. 1862.
= *Anthoboscus perspicillum*, Chevr. 1863.
= *Clytanthus perspicillus*, Thoms. 1864.

Mr. Pascoe, though at first disinclined to sanction the dismemberment of *Clytus* (see Journ. of Entom. i. 360), recognizes *Xylotrechus* and *Clytanthus* as genera, but holds (I believe) that if the old genus is to be broken up, the subdivision must be carried further than has yet been done; and that if any of these groups are to be separated from *Clytus*, the *Anthoboscus* group and the *Chlorophorus* group should be separated from each other.

It would seem that the only point upon which Messrs. Chevrolat, Mulsant, Thomson, and Pascoe are agreed is this—that the old genus *Clytus* has become so unwieldy as to require the formation at its expense of several genera; but it is sufficiently apparent from what precedes that each of these authorities differs from every other of them as to the limits of the groups to be separated, and the contents of the genera to be formed.

I confess my inability to appreciate, as of generic value, the minute distinctions upon which some of the above-mentioned off-casts from *Clytus* are founded, and

I cordially agree with Mr. Thomson both when he sinks *Sphegesthes* and replaces *arietis* as the type-species of *Clytus*, and also when he re-unites *Anthoboscus*, *Chlorophorus*, and *Isotomus*. An author who has created Cerambycide genera by the hundred * is not likely to err on the side of too great sternness in refusing recognition to the creation of others.

If I have rightly understood Mr. James Thomson, the three genera *Clytus*, *Clytanthus*, and *Xylotrechus* stand as follows: †—

Gen. Clytus.

Clytus, Laich. Tyr. Ins. ii. 88 (1784); *nec al. auct.*
> *Clytus*, Thoms. Essai, p. 217 (1860).
> *Europa* = } = *Xylotrechus* (2nd div.), Thoms. Essai,
> *Clytumnus* } p. 221 (1860); (*nec Xylotrechus*, Chevr., Muls.).
> *Echinocerus*, Muls. Longic. de France, p. 143 (1862).
> *Sphegesthes*, Chevr. Clyt. d'Asie, p. 81 (1863).
= *Clytus*, Thoms. Syst. Ceramb. pp. 186, 424 (1864).
Type.—*C. arietis*, Lin.

Gen. Clytanthus.

Clytanthus, J. Thoms. Syst. Ceramb. p. 190 (1864).
< *Clytus*, Fab., Lap. & G., *et al.*
> *Anthoboscus*, Chevr. Ann. Soc. Ent. Fr. 1860, p. 455.
> *Xylotrechus* (3rd div.), Thoms. Essai, p. 221 (1860); *nec* Chevr., Muls.
> *Isotomus*, Muls. Longic. de France, p. 183 (1862).
> *Chlorophorus*, Chevr. Mém. Soc. Sci. de Liége, 1863, p. 38.
Type.—*C. tricolor*, Chevr.

Other species belonging to this genus are *annularis*, Fab., *bidens*, Fab., *comptus*, Mannerh., *semipunctatus*, Fab., *Macaonensis*, Chevr., &c.

* "Le *Systema Cerambycidarum* en a fait connaitre 1178 genres, dont *plus d'un tiers* sont de ma création." (J. Thoms. Syst. Ceramb. p. 497).

† The sign = has been long used to denote that two names are synonymous. I venture to adopt (from the Transactions of an American Society) the user of the algebraical signs > (greater than) and < (less than), for the purpose of showing which is the major and which the minor group, when the names are not perfectly synonymous, but belong to groups which are not co-extensive. Thus *Clytanthus* < *Clytus* shows that *Clytanthus* is less extensive than and was included in *Clytus*; whilst *Clytanthus* > *Chlorophorus* shows that *Clytanthus* is more extensive than and includes *Chlorophorus*.

Gen. Xylotrechus.

Xylotrechus, Chevr. Ann. Soc. Ent. Fr. 1860, p. 456; Clyt. d'Asie, p. 59 (1863).
< *Clytus*, Fab., Lap. & G., *et al.*
= *Xylotrechus* (1st div.), Thoms. Essai, p. 221 (1860).
= *Xylotrechus*, Thoms. Syst. Ceramb. pp. 190, 424 (1864).
Type.—*X. Sartorii*, Chevr.

Other species belonging to this genus are *liciatus*, Lin., *Chinensis*, Chevr., *vicinus*, Lap. & G., *quadripes*, Chevr., *ocellatus*, L. & G., &c.

The diagnostic characters given by Mr. Thomson (Syst. Ceramb. p. 424) are as follows :—

Clytus. *Antennæ* breves, artic. 3° seq. longiore.
Prothorax subglobosus, oblongus.
Pedes postici elongati, ♂ femora postica corpus transientia.

Clytanthus. *Antennæ* graciles, breve, artic. 3° seq. longiore.
Prothoraæ rotundatus.
Elytra apice truncata.
Prost. append. angusta; *mesost.* append. lata.
Corpus elongatum, angustatum.

Xylotrechus. *Frons* plus minusve *longitud. carinata.*
Antennæ breves, artic. 3° seq. longiore.
Prothoraæ subovalis.
Elytra paulò brevia.
Prost. append. angusta; *mesost.* append. lata.
Pedes postici elongati.

When it is borne in mind that Mr. Thomson has another genus, *Clytosaurus*, which comes between *Clytanthus* and *Xylotrechus*, it will be seen how very slight are the differences which separate these various groups.

The only conclusion at which I arrive with certainty is this—that there is still much to be done with this group of *Clytinæ* before their classification can be deemed satisfactory. M. Chevrolat appears to me to have failed to give any distinct characters by which his *Anthoboscus*, *Clytus* (true), *Xylotrechus*, *Chlorophorus*, and *Sphegesthes* can be discriminated; and whilst grateful for the reduction of these five groups into three, and for the merger of M. Mulsant's *Echinocerus* and *Isotomus*, I cannot but feel that Mr. James Thomson has left us in obscurity as to the real boundaries of *Clytus*, *Clytanthus*, and *Xylotrechus*.